suggesting that there was little obvious turnover between the localities. Of the Kaieteur species which were definitely identifiable (i.e., excluding *Nasutitermes, Embiratermes,* and *Anoplotermes* genus-group species to which we were unable to assign species names) only *Termes fatalis, Neocapritermes* n. sp. A, and *Coptotermes testaceus* were not also recorded from Kartabo, and of these the last has been recorded from elsewhere in Guyana (Araujo 1977. Catalogo dos Isoptera do Novo Mundo. Academia Brasileira de Ciencias, Rio de Janeiro). The four *Nasutitermes* to which we have been unable to give species names may or may not fit into existing species concepts; we simply do not have enough specimens to be certain. The *Neocapritermes* species and three *Anoplotermes*-group species appear to be new to science. Taken with samples collected during the same sampling trip in Paruima, Cuyui-Mazuruni, Guyana, 17 new species of *Anoplotermes* were collected in seven days of field work (Davies et al., unpublished data).

In a provisional study of this kind, one might expect to pick up only the most common and widespread taxa. More detailed sampling in the varied habitats of the reserve would undoubtedly reveal numerous other species, some perhaps more characteristic of this unusual habitat.

This is no. 36 in the Smithsonian's BDG publication series and contribution no. 99-202-J of the Kansas Agricultural Experiment Station. We are grateful to Vicki Funk, Carol Kelloff, and their staff for support and guidance, and to James Singh and Dyyantie Naraine of the Center for the Study of Biodiversity, University of Guyana, for extending to us every courtesy.

Paul Eggleton, Richard Davies, *Entomology Department, The Natural History Museum, London, SW7 5BD, U.K. (e-mail: pe@nhm.ac.uk)*; Matthew D. Kane, *Laboratory of Molecular Systematics, National Museum of Natural History, Smithsonian Institution, Washington, D.C., MD 20746, U.S.A.*; and Srinivas Kambhampati, *Department of Entomology, Kansas State University, Manhattan, KS 66506, U.S.A.*

PROC. ENTOMOL. SOC. WASH.
101(3), 1999, pp. 689–692

## NOTE

## *Otiorhynchus ovatus, O. rugosostriatus,* and *O. sulcatus* (Coleoptera: Curculionidae): Exotic Weevils in Natural Communities, Mainly Mid-Appalachian Shale Barrens and Outcrops

The Palearctic, mainly European genus *Otiorhynchus* Germar is represented in North America by 16 adventive species that were introduced, and have been further spread, with shipments of nursery stock or other horticultural products (Warner and Negley. 1976. Proceedings of the Entomological Society of Washington 78: 240–262; Maier. 1978. Environmental Entomology 7: 854–857; Johnson and Lyon. 1988. Insects that Feed on Trees and Shrubs. Cornell University Press, Ithaca, NY, 556 pp.). Several species, including *O. ovatus* (L.), *O. rugosostriatus* (Goeze), and *O. sulcatus* (F.), have become pests of agricultural and horticultural crops (Essig. 1933. California Department of Agriculture Monthly Bulletin 22(7–11): 379–409). Adults are flightless, parthenogenetic, and mainly nocturnal and univoltine. These three species are polyphagous, with larvae generally more host restricted than adults (Smith. 1932. United States Department of Agriculture. Technical Bulletin 325: 1–45; Essig 1933; Warner and

Negley 1976; Nielsen and Dunlap. 1981. Annals of the Entomological Society of America 74: 60–65; Lehman. 1983. Regulatory Horticulture 9(1–2): 19–20; Masaki et al. 1984. Applied Entomology and Zoology 19: 95–106.

*Otiorhynchus* weevils, now widespread in eastern and western North America, tend to be patchily distributed (Warner and Negley 1976). They are found most often in greenhouses, nurseries, landscape plantings, vineyards, strawberry plantations, and in other agricultural crops (Downes. 1931. Canada Department of Agriculture Pamphlet 5 (n.s.) (2nd rev. ed.): 1–19; Smith 1932; Essig 1933; Warner and Negley 1976; Brandt et al. 1995. Canadian Entomologist 127: 595–604). *Otiorhynchus* species are reported less often from natural communities (Downes 1931) or from wild hosts (Maier 1978; Maier. 1986. Journal of the New York Entomological Society 94: 70–77; Nielsen and Dunlap 1981).

Adults of *Otiorhynchus* species were observed during a study of insects associated with moss phlox in shale barrens and outcrops in the mid-Appalachians (Wheeler. 1995. Virginia Journal of Science 46: 148). Mats of this prostrate phlox were sampled by shaking them over an enamel pan and recording the numbers of *Otiorhynchus* species present. Representative specimens were collected for later confirmation of field identifications. Sampling was conducted mainly from early or mid-April through June 1989–1996 (Wheeler. 1995. Proceedings of the Entomological Society of Washington 97: 435–451). Numbers in parentheses in the following collection records refer to adult weevils observed in the field. Voucher specimens have been deposited in the Cornell University Insect Collection, Ithaca, N.Y.

### *Otiorhynchus ovatus* (L.)

The strawberry root weevil, first recorded in North America from Massachusetts in 1852, now occurs transcontinentally in Canada and the northern United States. Records also are available for many southern states (Warner and Negley 1976). Best known as a pest of strawberry, this species is a generalist that feeds on young conifers and conifer seedlings (Lehman 1983; Brandt et al. 1995). In non-agricultural settings, *O. ovatus* occurs in British Columbia on rocky islands and on mountains up to about 1,220 meters above sea level (Downes 1931).

Collection records.—MARYLAND: Allegany Co., Boy Scout shale barren, Sideling Hill Wildlife Management Area, E. of Little Orleans, 28 May 1996, at base of *Penstemon canescens* (1); Fifteen Mile Creek Rd. at Piclic Rd., Green Ridge State Forest, 23 May 1993, ex *Phlox subulata* (1). MICHIGAN: Marquette Co., sand dunes, Rt. 28 E. of Harvey, 25 July 1991, under *Hudsonia tomentosa* (5). OHIO: Guernsey Co., Twp. Rd. 871, N. of Winterset, 19 May 1991, ex *Phlox subulata* (1). VIRGINIA: Alleghany Co., Rt. 18 nr. Boiling Spring, 14 May 1989, ex *Phlox subulata* (3); Rt. 311 N. of Sweet Chalybeate, 14 May 1989, ex *Phlox subulata* (1); Highland Co., Head Waters shale barren, 2 June (1) and 23 June 1990 (1), ex *Phlox subulata*; Shenandoah Co., Short Mountain shale barren, 4.8 km SE. of Mount Jackson, 11 May 1991, ex *Phlox subulata* (1). WEST VIRGINIA: Greenbrier Co., Kates Mountain shale barren, S. of White Sulphur Springs, 14 May 1989, ex *Phlox subulata* (1); Hardy Co., shale outcrop, Lost River Rd., NW. of Lost River State Park, 5 May 1990, ex *Phlox subulata* (1).

### *Otiorhynchus rugosostriatus* (Goeze)

The rough strawberry root weevil was first reported from North America from the mid-Atlantic states in 1876. It now occurs in British Columbia, Nova Scotia, Ontario, and Quebec, Canada, and in the United States from Rhode Island south to North Carolina and from Washington to Arizona and California. It is an occasional pest of raspberry and strawberry (Essig 1933; Wilcox et al. 1934. Oregon Agricultural Ex-

periment Station Bulletin 330: 1–109; Warner and Negley 1976; McNamara. 1991. *in* Bousquet, Y., ed., Checklist of Beetles of Canada and Alaska. Research Branch Agriculture Canada Publication 1861/E.).

Collection record.—WEST VIRGINIA: Hardy Co., shale outcrop, Lost River Rd., NW. of Lost River State Park, 5 May 1990, ex *Phlox subulata* (1).

*Otiorhynchus sulcatus* (F.)

The first North American record of *O. sulcatus,* the black vine weevil, was from Massachusetts in the early 1830s. The North American distribution, which is less extensive and more spotty than that of *O. ovatus,* includes Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Quebec in Canada, as well as 25 states from Maine to North Carolina and from Alaska to Arizona and California (Warner and Negley 1976; McNamara 1991). The black vine weevil, an important pest of landscape and nursery plants, feeds on more than 150 plant species (Warner and Negley 1976; Masaki et al. 1984; Johnson and Lyon 1988; Lehman. 1989. Regulatory Horticulture 15(1): 17–19). Known wild hosts of *O. sulcatus* are mainly plants near container-grown nursery stock or those in fencerows or woods adjacent to nurseries and suburban landscape plantings (Nielsen and Dunlap 1981; Maier 1986). In British Columbia, Cram and Pearson (1965. Proceedings of the Entomological Society of British Columbia 62: 25–27) found that adult black vine weevils feed on leaves of certain common weeds in peat bogs where blueberries and cranberries are grown.

Collection records.—VIRGINIA: Highland Co., Head Waters shale barren, 26 June 1994, ex *Phlox subulata* (1); Shenandoah Co., Short Mountain shale barren, 4.8 km SE. of Mount Jackson, 14 April 1991, ex *Phlox subulata* (1). WEST VIRGINIA: Greenbrier Co., Kates Mountain shale barren, S. of White Sulphur Springs, 2 June (2) and 23 June 1990 (1), ex *Phlox subulata*; Hampshire Co., shale outcrop, Rt. 50, Shanks, 14 May 1989, ex *Phlox subulata* (3).

## Discussion

Some of the shale barrens and outcrops where *Otiorhynchus* weevils were found are near crop fields and major highways. Examples are the Head Waters shale barren near Rt. 250 in Virginia and the shale outcrop along Rt. 50 at Shanks, W. Va. Other collection sites, further removed from highways and agriculture, are less subject to anthropogenic influence; they include the Boy Scout shale barren in Maryland and Virginia's Short Mountain shale barren.

The exotic weevils *O. ovatus* and *O. sulcatus* have colonized shale barrens and shale outcrops of the mid-Appalachians, but the status of *O. rugosostriatus,* encountered only once, is uncertain. *Otiorhynchus ovatus* and *O. sulcatus* adults might use moss phlox for more than shelter. About half of the collections were from shale barrens or outcrops with mats of phlox 1–3 meters from other plant species. It is unlikely that all adults shaken from mats of moss phlox had crawled there after having developed on other host species in shale barrens and outcrops. The black vine weevil adult shaken from moss phlox at the Head Waters shale barren on 26 June 1994 was teneral, suggesting that development had occurred on the plant. In addition, adults of *O. ovatus* were found in Michigan sand dunes under *Hudsonia tomentosa* isolated (>2 m) from other plant species, suggesting that beach-heather serves as a host plant. Roots of moss phlox and other plants that harbored adults of *Otiorhynchus* should be examined for weevil larvae to try to verify a host relationship with these plant species.

I gratefully acknowledge E. R. Hoebeke

(Cornell University) and R. D. Lehman (Pennsylvania Department of Agriculture) for confirming identifications of *Otiorhynchus* species, and P. H. Adler (Clemson University) for constructive suggestions on an earlier draft of the manuscript. I also thank M. A. Berdine (The Nature Conservancy) for taking me to the Boy Scout shale barren in Maryland.

A. G. Wheeler, Jr., *Department of Entomology, Clemson University, Clemson, SC 29634, U.S.A. (e-mail: awhlr@clemson.edu)*

PROC. ENTOMOL. SOC. WASH.
101(3), 1999, pp. 692–694

NOTE

## The Occurrence of *Adicrophleps hitchcocki* Flint (Trichoptera: Brachycentridae) in the Diet of Brook Trout, *Salvelinus fontinalis* Mitchell, in a Small Headwater Stream in Maryland

Analyses of trout diet provide information about water quality and the species and sex ratios of food items. Such studies also support evaluating ecological models of predator-prey relationships and identify taxa important to sustaining growth and reproduction for a particular population of trout. Investigations that span at least a year can provide seasonal information on species being consumed, and thus indicate emergence patterns of the insects on which the trout feed (Elliott. 1967. Journal of Applied Ecology 4: 59–71). Stomach samples of an alpine brook trout population in Wyoming showed that trout feed on the caddisfly, *Glossosoma verdona* Ross, at a minimum of two periods in its life cycle (Duffield et al. 1995. Journal of the Kansas Entomological Society 67: 277–282). The first occurs during the adult emergence and the second occurs when the female caddisflies return to the water to oviposit. Studying another Wyoming stream, Hubert and Rhoades (1989. Hydrobiologia 178: 225–231) showed that brook trout feed on a variety of aquatic organisms from July through September. This diet included the immatures of five families of Trichoptera, with the trout showing preference for Trichoptera larvae as well as beetle larvae. Analysis of the diet samples also showed that aquatic organisms were gradually replaced by terrestrial items as the seasons progressed.

Here we report that the caddisfly, *Adicrophleps hitchcocki* Flint, occurs in the diet of a natural population of brook trout, *Salvelinus fontinalis* Mitchell, in Clifford Branch, a small headwater stream in Frederick County, Maryland. Clifford Branch is a first/second order stream (39°30′N, 77°27′E) which runs southeast from the Catoctin Mountains originating in the Frederick Municipal Forest. It is approximately 1.5 miles long and joins Tuscarora Creek to empty into the Monocacy River. The watershed of Clifford Branch consists of a mixed hardwood forest. The streambed is gravel and small stones. Many of the rocks in the upper reaches are covered with *Fontinalis* sp., an aquatic moss.

Brook trout were caught using artificial flies at various times between 9:00 AM and 7:00 PM, between January 1993, and June 1994. Samples of stomach contents were obtained using a stomach pump as described by Duffield and Nelson (1993. Aquatic Insects 15: 141–148).

Stomach contents from 453 *S. fontinalis* collected at Clifford Branch contained a total of 9,666 items. The total samples obtained per month ranged from 0 (July) to 85 (April), with a mean of 38 (Table 1). The